

the Old Course. In the last 40 years the sea has been receding to such an extent that in the new land there is plenty of territory of the right topography for a modern course.

Sir Nairne Stewart-Sandeman, Major Cecil Hutchison, and Sir Guy Campbell have been prime-movers of the 15-year-old effort to locate a modern course at St. Andrews and preserve the town's status as a golfing mecca. Golf constitutes a major factor in the town's income but the traditional lure is fast weakening due to the obsolescence of the famed Old course. Competent American appraisers of golf course architecture and playing interest declare that St. Andrews Old Course is far inferior to many other less ballyhooded courses in England, Scotland and the United States.

There has been persistently increasing mention in the United States of the Old

Course's shortcomings, consequently a definite drop in the former desire of American golfers to make a pilgrimage to the shrine. Proponents of the new course have told, with considerable validity, that a modern course would bring again to St. Andrews the easy spenders who figure it's a toss-up between St. Andrews and the Pyramids as relics, and that they can pass up both items of historic interest.

Not much opposition appears to be in the way of the town putting in the new course with a guarantee that construction expense will not exceed an amount that's very reasonable, considering the probable increase of outside money brought to St. Andrews by a modern course. Some natives are strong for the seaside plot being used as a bathing beach and promenade. You can get that at Coney Island, in case St. Andrews decides to compete.

DRAINAGE FIRST

By JOHN MONTEITH, Jr.

You can't grow turf unless you've licked your course's drainage problems

POOOR drainage is responsible for the loss of much turf as well as for a tremendous amount of poor turf on golf courses. To remain healthy our common turf grasses must find in the soil adequate food, water and air. A perfectly balanced food supply for grasses, as for man, is of no avail if there is not available enough water or air. Most grasses can not survive long with merely a supply of air available only to the leaves; they must have oxygen from air in the soil to maintain a healthy growth of roots.

In a loose open soil such as found in cultivated fields, moisture and air can penetrate readily. Even in natural stands of vegetation the soil is kept loose by the heaving of frost and the activities of earthworms and other small members of the animal world. On golf courses, however, soils are packed by constant use of machines and the trampling of players. Earthworms, grubs and other burrowing animals are discouraged as much as possible. Consequently the porosity of the soil on golf courses is quite different than

it is in cultivated fields or in wild places where grasses thrive.

When soil becomes saturated with water the air is forced out of the soil. To realize readily how this process works one may take a glass full of marbles. Each marble represents a particle of soil. Air fills the spaces between the marbles but is readily forced out when the glass is filled with water. The air cannot return to the spaces between the marbles until the water is drained off. If the water is left in the glass it can escape only by evaporation. As the water evaporates the spaces in the upper layer are gradually filled with air. In the lower part of the glass there is no air for a long period of time; an even longer time in cold, cloudy weather. On the other hand if there is a crack in the bottom of the glass



A short shallow tile line through a low wet portion of fairway costs little and helps the turf as well as playing conditions in wet seasons.

which will permit water to escape, fresh air is drawn down between the marbles in the glass as the water drains off. Each time the glass is filled with water and this water leaks away there is a complete change of air in the spaces between the marbles.

Drainage Provides Air to Soil

Tile, gravel subsoil, or other good drainage conditions provide for soil the same air changes as the crack in the above glass makes it possible for air to come in around the marbles. Heavy rain or sprinkling forces the air from the pores and crevices in the soil and, if the excess water can escape readily, new air is drawn down into the soil. Good drainage does not mean that every bit of water will go down through the soil because as the water seeps through the ground a film of moisture remains around each of the innumerable particles of soil. The film of water around each particle of soil is sufficient to provide grass roots with all the water they require. Heavy showers or ample watering can therefore serve the dual purpose of providing the plant with moisture and of changing soil air supplies,

but this can only be accomplished with adequate drainage. Without good drainage an excess of water remains in the soil and seals the lower depths from air for long periods.

There may be excess water in the soil from a direct or indirect source. The direct and obvious source is rain or sprinkling. The indirect source is seepage which is usually not apparent and therefore more likely to be overlooked and neglected.

When one suggests poor drainage as a possible reason for turf injury to club members it is by no means uncommon to hear the exclamation, "That can't be the case on this course for with all these hills drainage can't be a factor!" These individuals forget that in hilly country springs are common. Water that seeps through the soil often reaches a shelf of rock, slate or hardpan. It then slowly moves through the soil on the shelf until it finds an outlet. If it reaches a crevice through which it may flow readily, it may come to the surface somewhere down the hillside as a spring. If it continues along this ledge it may come out on a green or fairway over a wide area and there



Poor surface drainage is indicated by the puddles of water on important turfed areas of this course.

make one of those soggy areas that are altogether too common on golf courses.

Puddles Are Warning of Future Trouble

When too much water falls on turf or when it falls too rapidly, the excess runs off the surface. If surface drainage is not adequate pools of water will collect. Puddles of water are objectionable not only from the playing standpoint but may also result in poor weedy patches of turf. This condition is particularly likely to cause trouble on northern courses in late winter or early spring. On southern courses this condition is more likely to occur in mid-summer. The damage from inadequate soil drainage is likely to occur gradually at any time during the growing season. Unfortunately injury to turf due to poor soil drainage is apt to be most noticeable at the season when its cause is not apparent. Frequently the suggestion of poor drainage brings the reply, "Why, we have had no rain for weeks and we have used no water here all season." That is just how poor drainage usually works. A soggy soil with air only in the upper inch or so does not provide favorable conditions for turf growth. The root system remains shallow. Weeds like clover and *poa annua* which are better able to survive with shallow root systems

than are the finer turf grasses naturally begin to dominate in such areas. As long as there is sufficient moisture and heat, and if evaporation is not excessive, these areas remain green and are apparently "doing nicely, thank you!" When dry weather comes and seepage water no longer provides adequate moisture for this shallow rooted covering the trouble begins. The deeper rooted grasses in well-drained soil can better survive such unfavorable conditions. They remain as a sharp contrast to the injured areas which were most likely the greenest and best looking turf until affected by the unfavorable conditions. No wonder club members are often puzzled by the explanation of "poor drainage" for injury that occurs in periods of drought.

The only way to prevent injury due to poor drainage is to provide good drainage. The time to provide it, however, is not when the injury begins to show but months before when the real damage to the root system is taking place. For those in charge of golf courses it is therefore advisable that in the spring (or old) man's fancy turn to thoughts of drainage. When courses are still wet with spring rains or thawing snow, then is the time to locate areas where soil drainage is inadequate. The cost of tile drainage is low considering the benefits derived. Even if tiling operations cannot be carried on at once, every greenkeeper should look over his course carefully in the spring. Areas where tiles are needed should be definitely located and recorded, so that they may be wisely placed at some later date when funds and labor are available. As a matter of fact, a cheaper and much better job of drainage can be done when the soil is in good working condition than can be done when it is saturated with water.

Is System Functioning?

We frequently hear it argued that drainage cannot be the cause of some particular turf injury because "that area is already tiled." That may be true. The important question is whether or not that tile system is still functioning. Many a well-laid tile line is worthless because it is plugged with soil, roots of trees, or a crushed or misplaced section. At times changes have been made since the tile line was laid which have cut off or closed the outlet.

If an area known to contain tile does not seem to drain well, that line should be examined. If no diagram of the tile system is available (which is the unfortunate case on many courses) it is possible to locate a line readily with a simple pointed rod commonly known as a "feeler." By systematically poking this feeler into wet soil until the tile is felt one can soon trace it across any area. When located, a chart should be made to permanently locate its position. The outlet of the tile should be examined to determine how much water is flowing from it. In wet weather a good flow of water may come from only a fraction of a tile line. When the soil is not well drained a section at the upper end of a suspected tile line may be removed and water from a hose



Samples of tile from a line that no longer drained. Do you wonder why?

may be flushed through the line to determine if it is open. If it is found to be clogged it may not be necessary to remove the entire line. A section removed here and there along the line will soon show the exact location of the clogging. In such a search one should first suspect trouble at intersections or areas where there appears to have been some settling of the soil.

Flow of Water

No Sign Tile Is OK

At times tiles do not function properly even though water flows through them readily. This is normally due to improper laying of the tile or a sealing of the joints with a sticky clay. When tile is laid and covered with heavy clay, especially when it is very wet, the tile may prove to be about as ineffective as if it were sealed in a thick layer of putty.

In laying tile every effort should be made to place the line in the most effective position and then to do a good job in laying it. One good tile line properly

placed is far better than half a dozen poor, inefficient lines.

In placing drains for seepage water it should be remembered that it is far better to intercept that water before it reaches an important piece of turf than it is to try to remove it directly from the affected area. It is also well to remember that unless the intercepting line is placed deep enough it may be ineffective if seepage water continues to creep along a shelf below the tile line. The tile must be placed below the surface of that ledge. All tiles should have ample fall and should be well covered with some open materials such as gravel, crushed rock or cinders. It cannot be too often urged whenever a new tile line is laid or an old one is located that a record should be made and filed which will make it possible to easily locate that tile in the future.

"An Introduction to Soil Science" Brings Fundamentals Up To Date

A NEW textbook, "An Introduction to Soil Science," by Benjamin Isgur, instructor in soils at the Massachusetts State college, has just been published by the Agricultural Scientific Publishing Co., 27 Beach St., Boston. This book, which sells for \$2.90, brings up to date the fundamentals of soil science.

Isgur has tried to make his work a practical handbook of soil culture and has more than succeeded in so doing. An important feature of this volume is a diagnostic table or key which any greensman can use to "run down" his soil troubles. Another important feature to the greenkeeper is a method of determining the relative value of peats in increasing the available water in the soil.

Main topics which are of especial importance and interest to greenkeepers and golf clubs for the maintenance of fine turf areas are: soil texture and soil structure (with an explanation of soil puddling); organic matter and peats; soil bacteria; soil acidity and liming (with an easily understandable explanation of the meaning of pH, and with explicit directions as to how much lime to apply to obtain suitable soil reactions); soil moisture and drainage systems; and a chapter on fertilizers with an easily understandable chart which shows what happens to fertilizers when they are applied to the soil under both favorable and unfavorable conditions.